

above and one below. The number of gills could not be definitely ascertained, but there are five well-developed pleurobranchs and a single series of rudimentary arthrobranchs, as well as a series of epipods ceasing apparently on the third last leg. All the thoracic legs bear exopods, and the first two pairs are chelate.

Spence Bate's family Carycypidæ\*, being founded entirely on immature forms, cannot be sustained. It seems not unlikely that some at least of the species are larval Acanthephyridæ, and in the present instance the arrangement of the gills lends some support to this view.

*Distribution.* Various forms referred to the "genus" *Caricyphus* were taken by the 'Challenger' in the Pacific, and by the Plankton Expedition in the Atlantic, in all cases at or near the surface.

#### Family Paguridæ.

*Locality.* Lat.  $52^{\circ} 4' 5''$  N., long.  $11^{\circ} 20' 1''$  W. Net no. 1 b. 20 fath. 19/11/98. One specimen.

This specimen is a zoëa-larva at a stage in which none of the abdominal appendages are yet developed, although the telson bears seven pairs of spines instead of six as in the first stage of the Pagurid zoëa. It differs from the zoëa of *Eupagurus bernhardus* as described by Sars† in the shorter rostral spine and in the broader telson, the posterior margin of which is straight, not incised in the middle as in the earlier stages of that species, nor convex as in *Anapagurus chiroacanthus*.

LIX.—*Report on the Cœlenterata from the intermediate waters of the N. Atlantic, obtained by Mr. George Murray during the Cruise of the 'Oceana' in 1898.* By R. T. GÜNTHER, M.A., Fellow of Magdalen College, Oxford.

[Plates IX. & X.]

ALTHOUGH a great deal of care was bestowed upon the collection and preservation of the material presently to be described, it was not easy to refer some of the individual specimens to their proper place in the system. Many of

\* *Op. cit.* p. 927, Appendix B.

† "Bidr. til Kundskaben om Decapodernes Forvandlinger," Arch. f. Math. og Naturvid. xiii. p. 146, pl. ii. (1890).

the more delicate Hydrozoa lacked organs which must necessarily be examined before an unhesitating opinion with regard to their position in a classification can be formed. Their incompleteness was partly due to damage, almost inevitable when such flimsy creatures are removed from the depths of the Atlantic to an Oxford laboratory, and partly to their having been taken in November, at a season when senile decay has robbed them of organs characteristic of the prime of life earlier in the year.

Nevertheless, Mr. Murray's collection of the Hydrozoan fauna of the intermediate depths of the North Atlantic is quite sufficient to indicate some important and interesting facts of distribution.

The material was collected on the 19th, 20th, 21st, and 22nd of November, 1898, in various depths from 1770 fathoms to the surface, at about lat.  $52^{\circ} 20' N.$ , long.  $11^{\circ} W.$  to  $15^{\circ} W.$ , about 200 miles west of Valencia. The method of fishing has already been described by Mr. Murray in the '*Geographical Journal*.' Open tow-nets were towed in series at ascertained depths, and it was intended that the organisms common to the surface-nets and the deep nets should be subtracted from the total catch of the latter, so as to discount those organisms captured during the descent and ascent of the nets.

The method would be an absolutely perfect one if it were possible to rely upon the plankton of the various depth-zones being uniformly distributed during the interval of time which must necessarily elapse between the lowering and the raising of the series of nets. The obvious defect in the method is that it might lead to erroneous conclusions if the plankton be not uniformly distributed in a zone. The occurrence of particular species in dense swarms is a very well-known phenomenon, and it is not at all impossible but that open nets during their descent to the deeper waters might catch a great number of individuals of such a swarm which might be altogether missed by the nets following employed nearer the surface. However, although Mr. Murray's method is open to this objection, I think that the final results will show that it is a very useful and practicable one, and that even if a certain proportion of the results be discounted there will remain a balance in favour of Mr. Murray's main contention that the deeper intermediate waters of the ocean are inhabited by living organisms.

The details of distribution are set forth in the accompanying table. The figures in the fifth column show the number of individuals of all species captured in the nets





at the depths indicated in the previous column. The figures in the next give the total number of species captured in the haul, and the remaining columns show the proportions in which different species or groups of species occur in each catch.

It must, of course, be remembered that the distribution of life indicated in the table may only hold good for the late season of the year, and it is desirable that other collections should be made at other seasons and by nets which could be opened or closed with certainty at any desired depth.

The table shows that the richest hauls were made from depths below 1000 fathoms. The results of 32 hauls were submitted to me for examination; 17 hauls were from above 1000 fathoms and 15 from below 1000 fathoms. The average number of Cœlenterate specimens from the deeper hauls was about 21, whereas about 5 (that is, only a quarter) came on the average from the hauls of less than 1000 fathoms. It will, of course, remain an open question whether any individual specimen was caught at a considerable depth or quite near the surface; but I think that the figures just given demonstrate conclusively that the deeper waters, *i. e.* below 1000 fathoms, are not less densely populated than the more superficial waters, and that they teem with Cœlenterate life. And when a particular species is repeatedly present in the deeper hauls but is entirely absent from the more superficial, it may be assumed to be peculiar to the deep water.

## ANTHOMEDUSÆ.

### Tiaridæ.

*Bythotiara Murrayi*, gen. et sp. n.  
(Pl. X. figs. 4 & 5.)

A single specimen of this interesting new form was obtained in a haul from a depth of 1610 fathoms in lat. 52° 18'·1 N., long. 15° 53'·9 W. It was nearly globular in shape and 7 millim. in diameter. In general characteristics, and in the disposition of the gonads upon the manubrium, this Medusa resembles the Tiarid Anthomedusæ; but whereas the four radial canals in the latter are said to be, so far as I know without recorded exception, simple, in the new Medusa they fork at a short distance from the base of the manubrium; so that at first sight it seemed as if this form really belonged to the Cannotidæ, but the genital ridges are distinctly inter-radial in position, having nothing to do with the radial

canals, and are upon the manubrium, as in the Anthomedusæ. At the end of each of the eight canals there is a tentacle.

I have therefore no hesitation in establishing a new genus for this Tiarid, which seems to belong to the deep intermediate waters or mesoplankton of the Atlantic Ocean.

BYTHOTIARA, gen. nov.

*Characters.* Tiarid with four radial canals, which bifurcate and open into the circular canal by eight adradial terminal branches. Four gonads arranged interradially along the manubrium.

*Bythotiara Murrayi*, sp. n.

Umbrella nearly as high as broad. Manubrium divided into two regions; the proximal part receiving the four radial canals is squarish in cross section, bearing the gonads in four ridges along the interradiial angles. The distal region is smallest, free from gonads. Mouth surrounded by four oral lips. Four radial canals bifurcate close to the manubrium. Eight long tentacles at the ends of the eight adradial terminal branches.

I have much pleasure in naming the species after its discoverer Mr. George Murray.

LEPTOMEDUSÆ.

Thaumantidæ.

*Laodice Chapmani*, sp. n. (Pl. IX. figs. 1, 2, 3.)

One specimen of this fine form was obtained in lat.  $52^{\circ} 18' 1''$  N., long.  $15^{\circ} 53' 9''$  W., between 1070 fathoms and the surface. It measured  $17 \times 12$  millim. It differs from other species of *Laodice* hitherto described in the character and distribution of the gonads. The reproductive cells are developed upon four fimbriated processes of the subumbrella situated upon the course of the four radial canals at points rather nearer the manubrium than the umbrella margin in the proportion of 5 : 8. In *L. Chapmani* the gonads (fig. 2) are far more restricted to one point than in *L. cruciata*, *L. calcarata*, or even in *L. ulothrix*, in all of which Atlantic species they extend either to the manubrium or to the umbral margin.

Tentacles 32 in number. Over the junctions of the radial with the circular canal are four ocelli, each of which seems

to be provided with a central, clear, refringent, lenticular body surrounded by deeply pigmented cells (fig. 3).

The species is named after my former tutor, Mr. Edward Chapman, M.P., who, as Science Tutor and Fellow of Magdalen College, has done so much to promote the interests of natural science in Oxford.

### Æquoridæ.

#### *Halopsis ocellata*, Agassiz (?).

Two Æquorid Medusæ were taken from between 1470 and 1275 fathoms and the surface. They were without gonads, but possessed a short manubrium, a well-developed velum, a very muscular subumbrella, 8 radial canals, and about 60 and 42 tentacles respectively. The diameter of each was 6 millim. Owing to the imperfect preservation of the specimens, it is difficult to refer them to their proper position with any degree of certainty, although they would seem, if mature individuals, to belong to the genus *Octocanna*.

I am rather inclined, however, to consider them as immature forms of *Halopsis*, since they bear a considerable resemblance to the young of *Halopsis ocellata* as described by Agassiz ('North-American Acalephæ,' fig. 148).

### NARCOMEDUSÆ.

#### Solmaridæ.

#### *Solmaris* sp. (?).

Up to the present time this genus has been regarded as belonging to the southern rather than to the northern fauna; it is therefore a matter of considerable interest to find that the isolated case of a young *Solmaris* with 15 tentacles, recorded by Browne from Plymouth, has now been followed by others from 52° N. lat. from deep water. The 'Oceana' specimens were all taken in hauls from between 1300 and 1610 fathoms. The number of tentacles varied; six individuals having 28, 32, 32, 39, 40, and 43 tentacles respectively.

#### Cunanthidæ.

A Cunanthid (?) 11 millim. in diameter, with 12 tentacles and large tentacle-roots, was taken between 1670 fathoms and the surface.

## TRACHOMEDUSÆ.

## Geryonidæ.

*Liriope* sp. (?).

A single young specimen of almost spherical shape, 5 millim. in diameter, with four tentacles about 3 millim. long, was taken in a haul from a depth of 1275 fathoms on the 20th of November.

## Aglauridæ.

*Aglantha rosea*, Forbes. (Pl. X. figs. 6-8.)

By far the most abundant Medusa captured by the 'Oceana' was an *Aglantha*. It was found in hauls from almost all depths, occurring in the greatest numbers in catches made below 1000 fathoms; but in hauls from between 1600 and 1700 fathoms it becomes less frequent. The interior of the bell was often full of Copepoda.

There is some difficulty in identifying the species on account of the absence of manubrium, tentacles, sense-organs, and gonads. On the other hand, the eight radial canals, the thimble-shaped muscular umbrella, and the highly characteristic cone-shaped summit ("Scheitel aufsatz") suggest that this Medusa is *Aglantha rosea*.

Browne found fully developed *A. rosea* in April and May in Valencia Harbour. Maas describes *A. digitalis* from the Plankton Expedition material collected in July in the North Atlantic in the latitude of the Orkneys and Shetlands. It seems possible that fully developed *Aglantha* may live near the surface during the summer months, but may sink into deeper waters with the advancing season, and may then lose their manubria, tentacles, and other organs.

A typical 'Oceana' specimen is shown in fig. 6. Fig. 8 represents the margin of the umbrella (*u.*), from which the velum (*v.*) has become detached, tearing away with it a number of notch-like depressions (*te.*), which afford us some indication of the number (about 80) of tentacles. The tear has occurred along the line of the circular canal.

The exumbrella is produced into a characteristic cone-shaped summit, which is a highly variable structure. The *Aglantha* shown in fig. 6 may be regarded as of the normal shape; but in many individuals the cone-shaped summit has dwindled to the condition depicted in fig. 7. In no case, however, did an 'Oceana' specimen exhibit the other extreme variation described by Maas in *A. digitalis*, in which the summit was larger than the rest of the bell.



*Jelly-masses.*

In hauls from 1670 and 1770 fathoms were lenticular masses of jelly 20 and 13 millim. in diameter respectively, which seemed to have been parts of the umbrella of some Medusa which had died, perhaps, in a higher stratum of water. I have thought their occurrence worthy of notice, because a problem to which future investigators should turn their attention is that of the degree of permanence of the jelly, which forms the bulk of many pelagic organisms, after death and in the middle depths of the ocean. It would be interesting, for example, to learn the extent to which such jelly-masses are the food of organisms living in the greater ocean depths.

## SIPHONOPHORA.

## CALYCOPHORÆ.

## Monophyidæ.

*Sphæronectes gracilis*, Hæckel.

Specimens of about 8 millim. in diameter were taken in hauls from depths of 510, 810, 1510, 1670, and 1770 fathoms.

*Doramasia picta*, Chun.

To this species belong three individuals in a haul from 1570 fathoms and three taken in the three hauls from 1170, 1190, and 1300 fathoms.

## Diphyidæ.

*Diphyes bipartita*, Costa.*Eudoxia campanula*, Leuckart.

A number of *Eudoxia* were present in hauls from below 810 fathoms and down to 1610 fathoms.

It seems that they are to be identified with the *Eudoxia campanula*, Leuck., which was caught in such large numbers in the North Atlantic during the Plankton Expedition. It has already been shown that this species is often present in large numbers in the deeper waters of the Mediterranean and in the North Atlantic. Their relative abundance is indicated by the following catches made by the 'Oceana':—

Between 810 fathoms and the surface, 6 individuals.

„	920	„	„	2	„
„	950	„	„	2	„
„	1070	„	„	4	„

Between 1190 fathoms and the surface, 5 individuals.

„	1300	„	„	3	„
„	1410	„	„	4	„
„	1470	„	„	3	„
„	1610	„	„	11	„

*Praya* sp. ?

Isolated bracts in hauls from between 375, 1510, and ? 1170 fathoms and the surface.

*Diphyopsis* sp. ?

Specimens referable to this genus were taken in hauls from the very varying depths indicated in the table of distribution.

Polyphyidæ.

*Vogtia pentacantha*, var. *lævigatus*, nobis.

Isolated nectophores occur in the hauls from 620, 1275, and 1470 fathoms. In shape they resemble the nectophores of *Vogtia pentacantha*, Köll., but their margin is smooth, instead of being surrounded with spinous processes.

*Hippopodius* sp. ?

A damaged *Hippopodius* was found in the tube containing organisms taken between a depth of 1570 fathoms and the surface. The fragments must have belonged to a large species which might have been some 6 inches in length.

CTENOPHORA.

Beroidæ.

*Beroë ovata*, Esch.

A single specimen measuring 17 millim. long and 9 millim. in diameter was taken between 1510 fathoms and the surface.

*List of Authors referred to.*

- AGASSIZ, A.—‘North-American Acalephæ.’ 1865.  
 BROWNE, E. T.—“On British Medusæ.” Proc. Zool. Soc. 1897.  
 CHUN, C.—‘Die Siphonophoren der Plankton-Expedition.’ 1897.  
 HÆCKEL, E.—‘Das System der Medusen.’ Jena, 1879.  
 —. “Report on the Siphonophoræ collected by H.M.S. ‘Challenger.’” 1888.

- MAAS, O.—“Die Craspedoten Medusen.” *Ergebnisse der Plankton-Expedition.* 1893.  
 MURRAY, G.—“Exploration of the Intermediate Depths of the Ocean.” *Geogr. Journal*, xiii. pp. 147-154. 1899.

## EXPLANATION OF PLATES IX. &amp; X.

- Fig. 1.* *Laodice Chapmani*, sp. n.  
*Fig. 2.* Ditto. Genital organ upon one of the radial canals (*r.c.*).  
*Fig. 3.* Ditto. An ocellus seen from the side near the root of a radial tentacle (*te.*).  
*Fig. 4.* *Bythotiara Murrayi*, gen. et sp. n.  
*Fig. 5.* Ditto. Diagram showing the bifurcation of the radial canals (*r.c.*) and their relation to the base of the manubrium and its genital ridges (*g.*).  
*Fig. 6.* *Aglantha rosea*, with normally developed conical process upon the exumbrella.  
*Fig. 7.* Ditto. Exumbrella with shrunken conical process.  
*Fig. 8.* Ditto. Portion of umbrella margin near the termination of one of the radial canals (*r.c.*). The velum (*v.*) has partially separated from the umbrella along the line of the circular canal, and the zone of tentacular depressions (*te.*) has separated with it.

## BIBLIOGRAPHICAL NOTICES.

*Zoological Wall-plates.* By Prof. Dr. PAUL PFURTSCHELLER.  
 Pichlers, Witwe, and Son: Vienna and Leipsic. 1902.

JUDGING by the sample plates which have been sent us, the zootomic wall-diagrams of Prof. Pfurtscheller should find many purchasers in this country. They are obviously the outcome of a practical experience in the teaching of elementary zoological anatomy, and in small class-rooms would prove admirable adjuncts.

*Geological Survey of Canada. Contributions to Canadian Palæontology.*—Vol. VII. Part 2. *On Vertebrata of the Mid-Cretaceous of the North-west Territory.* By H. F. OSBORN and L. W. LAMBE. 4to. 84 pages; with frontispiece, 20 plates, and 24 blocks of text-figures. Ottawa, 1902.

I. *Distinctive Characters of the Mid-Cretaceous Fauna.*  
 By HARRY FAIRFIELD OSBORN.

THE determination by the Canadian Survey of a Mid-Cretaceous and freshwater fauna, including fishes, batrachians, reptiles, and mammals, is a forward step of great importance in vertebrate palæontology. The Belly-River formation has been determined geologically to be Mid-Cretaceous, lying lower in the series than the Montana[?] and the Fort Pierre and Fox Hills groups, and lying above the Fort Benton and Dakota. The Belly-River vertebrate